

Build Your Own D-STAR Hotspot



Figure 1 — The PiHat mounted on a Raspberry Pi3 microcomputer.

No D-STAR repeaters nearby? Assemble this inexpensive hotspot and join the D-STAR universe!

Bob Wilton, KF5TPQ

A D-STAR hotspot is a miniature repeater located inside your home. Using your D-STAR transceiver, you connect to the hotspot, and it uses your internet connection to link you to the global D-STAR network — just like a full-fledged D-STAR repeater.

There are commercially available hotspots, but you can create your own inexpensive version with a pre-built *PiHat* module that plugs directly onto the top of a Raspberry Pi microcomputer. This will effectively turn the microcomputer into a hotspot known as a *Pi-Star*.

Our PiHat is a multimode digital voice modem (MMDVM) hotspot that costs less than \$90, including the cost of the Raspberry Pi. I'll address the PiHat installation process that includes downloading the Pi-Star image and transferring it to an SD card, booting up Pi-Star for the first time, interfacing it to your Wi-Fi, and then configuring the resulting Pi-Star by using your radio. I will present a step-by-step process in order to make this easy, even for those with little D-STAR and Pi-Star knowledge.

Before beginning, you may want to review online resources on PiHat, Pi-Star, and Raspberry Pi computers. Helpful sources include the Pi-Star home-

page at www.pistar.uk, the Pi-Star manual at https://amateurradionotes.com/images/1-Playing_with_Pi-Star.pdf, and a guide for D-STAR at www.roblocher.com/whitepapers/dstar.html. There are also YouTube videos to help you understand D-STAR configurations.

Step 1

Once you've acquired an MMDVM hotspot board (search on Amazon) and a Raspberry Pi microcomputer, begin by plugging the PiHat onto the top of the Raspberry Pi, as shown in Figure 1 (above).

Next, go to www.pistar.uk/downloads and download the Pi-Star image (choose the one based on your Raspberry Pi model) to your PC. Insert an SD card into your PC, possibly using an adapter if needed, and install the image on the card using *Etcher* software (www.balena.io/etcher). Dismiss any system messages regarding SD card formatting because *Etcher* will do this for you.

Step 2

Insert the SD card into your Raspberry Pi, connect your power supply to the microcomputer, and let it boot. The Pi/Pi-Star will attempt to log into Wi-Fi, but after a few minutes, it will proceed to create its own hotspot.

When the hotspot installation has finished, you need to direct your PC to connect to it rather than your home Wi-Fi. Go to the Wi-Fi settings on your PC, choose **PI-STAR**, and select **CONNECT**. Enter "raspberrypi" when a password is requested.

Next, you need to connect to the Pi-Star portal on the Pi-Star. To do this, open your web browser on your PC, type "192.168.50.1" in the address bar, and press **ENTER**. You will soon see the Pi-Star Dashboard (see Figure 2).

To configure Pi-Star to work with your Pi/PiHat, select the **CONFIGURATION** button in the top right (if a setting is not mentioned, the default will work). Select **APPLY CHANGES** below each panel to update changes to that specific panel.

On the **CONTROL SOFTWARE** panel (see Figure 3), select **MMDVM HOST** and **SIMPLEX MODE**.

On the **MMDVM HOST CONFIGURATION** panel (see Figure 4), turn on D-STAR mode. On the Display Type, press the down arrow and select **OLED** to turn on the PiHat OLED display.

On the **GENERAL CONFIGURATION** panel (see Figure 5), set the node call sign to your D-STAR call sign.

Step 3

Set your D-STAR radio frequency to whatever you will use to communicate with the hotspot once it is configured. This frequency setting is for communication between the Pi-Star and the local radio (most PiStar hats only communicate on UHF).

Set up latitude and longitude for your location. Set your town and country, and set the radio/modem type to **STM32-DVM / MMDVM_HS — RASPBERRY PIHAT (GPIO)** via the dropdown selection. This is the setting for the PiHat I used. If you are working with a different PiHat, check the documents that come with it.

Set the node type to **PUBLIC** if other radios with different call signs will be using this hotspot. You most likely can leave the APRS Host set to the default, but look at the manual for more information. Finally, set the time zone and language to your requirements.

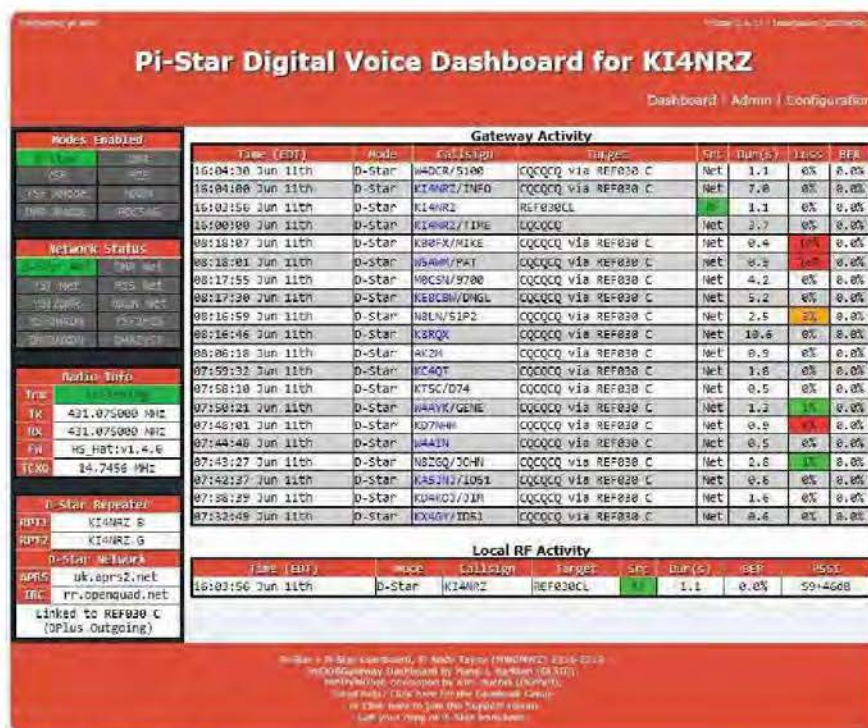


Figure 2 — The Pi-Star dashboard.



Figure 3 — The CONTROL SOFTWARE panel.

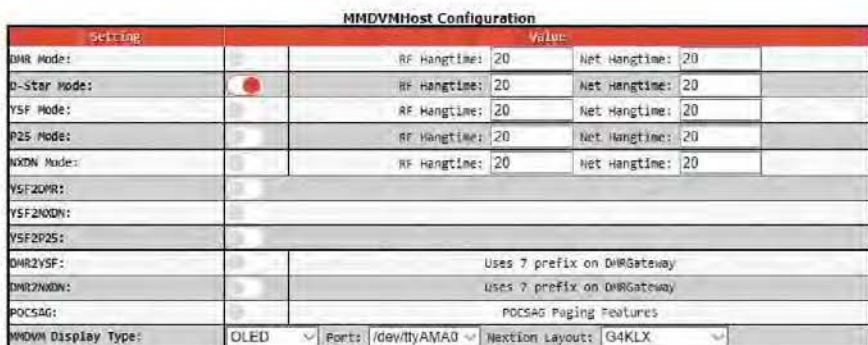


Figure 4 — The MMDVM HOST CONFIGURATION panel.

Step 4

In the **D-STAR CONFIGURATION** panel (see Figure 6), set the RPT1 call sign to your call sign if it wasn't automatically carried here from a previous entry. Enter a "B" for UHF, unless you have a PiHat that works in VHF, in which case enter a "C." The RPT2 will be generated automatically, and you'll note that "G" is for

"gateway." You can set up a default reflector on power up if you wish. The **FIREWALL CONFIGURATION** panel should default to the selections shown in Figure 7.

The **WIRELESS CONFIGURATION** panel (see Figure 8) configures the Pi-Star to work on your home Wi-Fi.

Select "Configure Wi-Fi" and input your home Wi-Fi SSID and password. Turn the P-Star power off and then on. When you do, the Pi-Star will connect to your Wi-Fi. You can now go back to your PC and change its Wi-Fi settings to connect to your home network.

Finally, you must determine the Pi-Star IP address that was assigned by your router. While the Pi-Star OLED display will eventually display the Wi-Fi IP address, you can download the *Advanced IP Scanner* (www.advanced-ip-scanner.com) and run it to find the new address. Once you have determined the Pi-Star IP address, enter it into your browser, and you will be able to connect to Pi-Star over your local Wi-Fi in case you ever need to access it to make changes.

This process should be easily reproducible by most hams. For additional help, go to the www.arrl.org/QST-in-Depth web page for a radio/D-STAR hotspot programming example.

Bob Wilton, KF5TPQ, holds a General-class license and has been licensed since January 2013. He attended a technical college where he studied electronic technology, after which he worked for 36 years in the large computer industry providing on-site customer technical support and engineering design and development support. Bob retired in 2011 and is now the ARES Emergency Coordinator for Towns County, Georgia, as well as the Secretary for the Mountain Amateur Radio Club in Hiawassee, Georgia. He enjoys working HF SSB DX as well as multiple digital modes, including PSK, JT9, JT65, FT8, and WinLink. You can contact Bob at bmwilton@live.com.

For updates to this article, see the **QST Feedback** page at www.arrl.org/feedback.



Setting	Value
Hostname:	pi-star
Node Callsign:	K14NRZ
Radio Frequency:	431.075000 MHz
Latitude:	34.93 degrees (positive value for north, negative for south)
Longitude:	-83.85 degrees (positive value for east, negative for west)
Town:	Young Harris
Country:	USA
URL:	http://www.qrz.com/db/K14NRZ
Radio/Mode Type:	STM32-DVM / MMDVM_HS - Raspberry Pi Hat (GPIO)
Mode Type:	Private Public
APRS Host:	uk.aprs2.net
System Time Zone:	America/New_York
Dashboard Language:	english_us

Figure 5 — The GENERAL CONFIGURATION panel.

Setting	Value
RPT1 Callsign:	K14NRZ B
RPT2 Callsign:	K14NRZ G
Remote Password:	*****
Default Reflector:	REF030 C
ircd08gateway Language:	English (US)
Time Announcements:	
Use DPlus for XRP:	

Figure 6 — The D-STAR CONFIGURATION panel.

Setting	Value
Dashboard Access:	Private Public
ircd08gateway Remote:	Private Public
SSH Access:	Private Public
Auto AP:	On Off
uPNP:	On Off

Figure 7 — The FIREWALL CONFIGURATION panel. The default values work as shown.

Wireless Configuration	
Refresh Reset WiFi Adapter Configure WiFi	
Wireless Information and Statistics	
Interface Name: wlan0	Connected To: ARRLS-F76R
Interface Status: Interface is up	AP Mac Address: 38:70:0c:94:f7:69
IP Address: 192.168.0.11	Bitrate: 57.7 MB/s
Subnet Mask: 255.255.255.0	Signal Level: -74 dBm
Mac Address: b8:27:eb:ed:0e:b0	Transmit Power: 31 dBm
Received Packets: 1835551	Link Quality: 36/70
Received Bytes: 157753008 (150.4 MiB)	
Transferred Packets: 357987	
Transferred Bytes: 75160457 (71.6 MiB)	
Information provided by ifconfig and nmap	
Remote Access Password	
User Name: pi-star	Password:
Confirm Password:	Set Password
WARNING: This changes the password for this admin page and the "pi-star" SSH account.	

Figure 8 — The WIRELESS CONFIGURATION panel.